BAYOU JOE MARCEL TMDL FOR FECAL COLIFORM

SUBSEGMENT 050102

US EPA Region 6

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the waterbody. A TMDL for both the May – October and November – April seasons have been developed for fecal coliform bacteria for Bayou Joe Marcel. Fecal coliform bacteria are monitored as the indicator for potential human health threats resulting from swimming.

Bayou Joe Marcel flows from its headwaters to Bayou Des Cannes, then into the Mermentau River. Bayou Joe Marcel segment 050102 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for primary contact recreation (swimming) and secondary contact recreation. Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

Seven months (June, 1998 – December 1998) of monthly LDEQ monitoring data on Bayou Joe Marcel was assessed to determine if the primary and secondary contact recreation uses were being maintained. Analysis of the data for the November – April season shows that the secondary contact recreation use is not being maintained (see Appendix A). Analysis of the data for the May – October season shows that the primary contact recreation use is not protected (see Appendix A). Therefore, a TMDL has been developed to protect the May – October and November – April seasons.

For the purpose of calculating current loading on Bayou Joe Marcel the average fecal coliform concentration for the May – October and November - April seasons were calculated using monthly LDEQ monitoring data on Bayou Joe Marcel. In Bayou Joe Marcel, the monthly fecal coliform counts range from 300 cfu/100ml to 16,000 cfu/100ml over the 7-month period (June, 1998 – December, 1998).

For the purpose of TMDL development, the criterion of 200/100mL was applied. A fecal coliform loading curve for the recreational period (May 1 – October 31) has been generated as

Figure 1. This loading curve was developed using Equation 1, substituting the criterion, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values. A 94% reduction in fecal coliform loading during the May – October season will be needed to protect the primary contact recreation use.

For the purpose of TMDL development, the criterion of 1000/100mL was also applied for secondary contact recreation. An 85% reduction in fecal coliform loading during the November – April season will be needed to protect the secondary contact recreation use.

1. Introduction

Bayou Joe Marcel segment 050102 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for both primary contact recreation (swimming) and secondary contact recreation uses. On the 1998 List, this segment was ranked as a high priority (1) for TMDL development. A TMDL for fecal coliform bacteria was developed in accordance with the requirements of Section 303 of the federal Clean Water Act. The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant; the TMDL also establishes the load reduction that is necessary to meet the standard in a waterbody. The TMDL consists of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The wasteload allocation is the load allocated to point sources of the pollutant of concern, and the load allocation is the load allocated to nonpoint sources. The margin of safety is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions and data inadequacies.

2. Study Area Description

2.1 General Information

Water quality subsegment 050102 is part of the Mermentau River Basin. The Basin encompasses the prairie region of the state and a section of the coastal zone. Bayou Joe Marcel is located in southwestern Louisiana in the Mermentau River Basin. The Mermentau River Basin is bounded on the north and east by the Vermilion-Teche Basin, on the west by the Calcasieu Basin and southward by the Gulf of Mexico. Land resources of the Mermentau River Basin consist of low relief prairie land interspersed with trees that line stream banks and some wetland areas. Natural vegetation in this region is comprised of bluestem, broomsedge, water grass, and switch grass. Vegetation introduced to the vicinity includes Johnson grass and carpet grass. The well-developed soil profile consists of dark to gray topsoil with an impervious claypan located approximately 14 inches below the surface. This claypan is conducive to rice farming because it holds water necessary for irrigation of the crops. Soybeans and crawfish are rotated with the rice crops. The average annual rainfall in the vicinity of Bayou Joe Marcel is approximately 57 inches. The land use for Bayou Joe Marcel watershed is summarized in Table 1.

Table 1. Land Uses in Segment 0501

LAND USE TYPE	NUMBER OF ACRES	% OF TOTAL AREA
Urban	4,092	2.55
Barren Land	86	0.05
Agricultural	121,401	75.75
Forest Land	18,853	11.76
Water	3,209	2.00
Wetland	9,055	5.65
Rangeland	3,561	2.22
Other	32	.02
TOTAL AREA	160,257	100

The area is sparsely populated outside its small municipalities and land use is dominated by agriculture.

2.2 Water Quality Standards

The designated uses for Bayou Joe Marcel include both primary contact recreation and secondary contact recreation. Fecal coliform bacteria serve as the indicator used for the water quality criteria and for assessment of use support. Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly: "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

2.3 Identification of Sources

Sources suspected of affecting the water quality of Bayou Joe Marcel include industrial and municipal sources, urban runoff, land disposal, hydromodification, as well as natural and other unknown sources (LDEQ 1993).

2.3.1 Point Sources

All of the discharges located in this watershed are small and need not be included in the model because it is unlikely that they are having an impact on the targeted waterbody due to the small load and/or distance from the waterbody named in the 303(d) lists. These small dischargers are accounted for as nonpoint loading in the load calculations (Baker et al., 2000).

2.3.2 Nonpoint Sources

The predominant land uses in the Bayou Joe Marcel watershed are agriculture and forestry. It is unknown to what extent each of these land uses contributes to fecal coliform loads through runoff. There are also numerous rural residences where other domesticated animals may be found. These rural residences may also contribute to the fecal coliform load if they have septic tanks or septic fields for their wastewater treatment.

3. TMDL Load Calculations

3.1 Current Load Evaluation

Fecal coliform loads have been calculated using the instream bacterial counts and the flow of the stream. The following equation can be used to calculate fecal coliform loads.

Equation 1. C x 1000mL/ L x 1 L/0.264 gallons x Q in gallons/day = cfu/day

Where: C = colony forming units/100mL
Q = stream flow in gallons/day

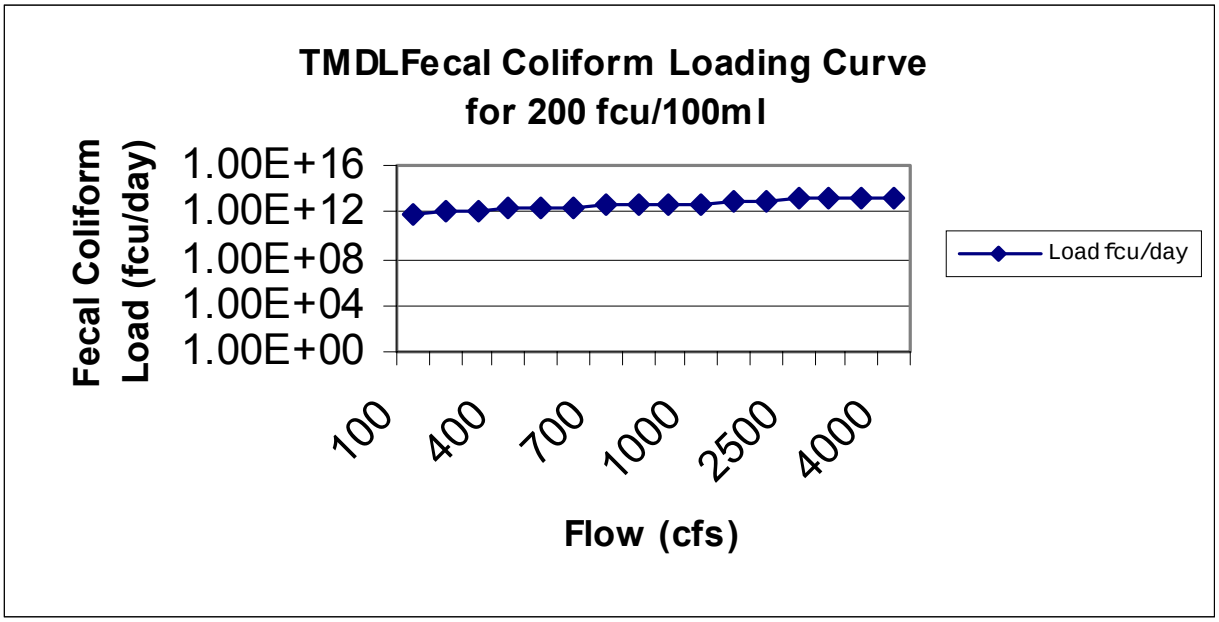
A traditional expression of the FC loading may be developed by setting one critical or representative flow and concentration, and calculating the fecal coliform load using Equation 1. The difficulty with this approach is in the determination of the appropriate flow or concentration value to use. For the purpose of calculating current loading on the this waterbody the average fecal coliform concentration for the May-October and November-April seasons were calculated using monthly LDEQ monitoring data on Bayou Joe Marcel. In Bayou Joe Marcel, the monthly fecal coliform counts ranged from 300 cfu/100mL to 16,000 cfu/100mL over a 7-month period (June, 1998-December, 1998). The average fecal coliform count for the May – October season is 3,487 cfu/100ml and for the November-April season is 6,433 cfu/100mL (see Appendix A). In addition, the average flow for Bayou Joe Marcel for the May – October season is 22.15 ft^3/sec and for the November-April season is 38.53 ft^3/sec (see Appendix B). Using these values and Equation 1 it is estimated that the current loading for the May – October season is 1.88E12 cfu/day and for the November-April season is 6.06E12 cfu/day.

3.2 TMDL

Point sources usually have a defined critical receiving stream low flow such as the 7Q10 at which the criterion must be met. For nonpoint sources it is recognized that there may be no

single critical flow condition. To address this condition, a TMDL fecal coliform loading curve for the recreational period (May 1 – October 31) has been generated as Figure 1. This TMDL loading curve was developed using Equation 1, substituting the criteria, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values. This curve is not stream dependent but is dependent upon the designated stream criterion. Therefore, it may be applied to any stream with a like FC criterion. This curve represents the TMDL loading allocation for FC.

Figure 1. TMDL Fecal Coliform Loading Curve for the May – October season.



Utilizing Figure 1, one can select a stream flow and can quickly determine the FC loading value. The line formed by this series of points may be thought of as a boundary. At any given flow the loading may be below the line, within the boundary, or above the line. FC load values falling above the line represent disproportionately high values relative to the standard. FC load values falling below the line represent low loads relative to the standard. To develop load reductions one simply needs to determine the appropriate flow value (x-axis) and see where it intersects the load allocation line.

The load reduction for the May-October season needed to meet the water quality standard for primary contact recreation in Bayou Joe Marcel at 22.15 cfs is 1.772E12 cfu/day (94% reduction). This was obtained by calculating the allowable TMDL at 22.15 cfs for the 200 cfu/100ml criterion (1.080E11cfu/day) and subtracting this load from the observed load (1.880E12 cfu/day).

Current Load - TMDL = Load Reduction

1.880E12 cfu/day – 1.080E11 cfu/day = 1.772E12 cfu/day

The load reduction for the November-April season needed to meet the water quality standard for secondary contact recreation in Bayou Joe Marcel at 38.53 cfs is 5.119E12 cfu/day (85% reduction). This was obtained by calculating the allowable TMDL at 38.53 cfs for the 1000 cfu/100ml criterion (9.410E11 cfu/day) and subtracting this load from the observed load (6.060E12 cfu/day).

Current Load - TMDL = Load Reduction

6.060E12 cfu/day – 9.410E11 cfu/day = 5.119E12 cfu/day

3.3 Wasteload Allocation (WLA)

Equation 1 can be used to calculate the total point source load (wasteload allocation) utilizing a fecal coliform count of 200 cfu/100 mL and the total volume of all the wastewater dischargers (0.0 gallons/day).

200 cfu/100mL * 1000mL/L * 1 L/0.264 gallons * Q gallons/day = WLA

Where Q = Total volume of sanitary wastewater discharges into Bayou Joe Marcel

WLA for all dischargers = 0.0 cfu/day

The above WLA is applicable during the November-April timeframe utilizing a fecal coliform count of 1000 cfu/100 mL in Equation 1 as well.

3.4 Load Allocation (LA)

The load allocation for each season for a given flow can be calculated using Equation 1 and the following relationship:

(TMDL@ given flow and criterion) - (WLA)= LA

LA for May – October season at an instream flow of 22.15 cfs = 1.08E11 cfu/day

1.08E11 cfu/day (TMDL@ 22.15 cfs) – 0.0 cfu/day (WLA) = 1.08E11 cfu/day

LA for November – April season at an instream flow of 38.53 cfs = 9.41E11 cfu/day

9.41E11 cfu/day (TMDL@ 38.53 cfs) – 0.0 cfu/day (WLA) = 9.41E11 cfu/day

3.5 Seasonal Variability

Louisiana has established a seasonal water quality standard for bacteria based upon definition of a summer swimming season and winter secondary contact only. In development of this TMDL data for all seasons were evaluated and it was determined that a TMDL for the May - October and November-April seasons were needed to protect the primary and secondary contact recreation uses.

3.6 Margin of Safety (MOS)

The Clean Water Act requires that TMDLs take into consideration a margin of safety. EPA guidance allows for the use of implicit or explicit expressions of the margin of safety or both. When conservative assumptions are used in the development of the TMDL or conservative factors are used in the calculations, the margin of safety is implicit. When a percentage of the load is factored into the TMDL calculation as a margin of safety, the margin of safety is explicit. In this TMDL for fecal coliform, conservative assumptions have been used and therefore, the margin of safety is implicit. These conservative assumptions are:

- Using average flows to calculate current loading to obtain load reduction.
- Using the more conservative 200 cfu/100mL standard rather than 400 cfu/100mL for the summer primary contact recreational season and 1,000 cfu/100mL rather than 2,000 cfu/100mL for the winter season.

4. Other Relevant Information

Although not required by this TMDL, LDEQ utilizes funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act to operate an established program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been established by the time the first priority basins are monitored again

in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following establishment of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Mermentau River Basin will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins
1999 - Calcasieu and Ouachita River Basins
2000 – Barataria and Terrebonne Basins
2001 – Lake Pontchartrain Basin and Pearl River Basin
2002 – Red and Sabine River Basins

(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

5. Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. EPA has transmitted this revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

REFERENCES

Baker, Jeff, William C. Berger, Jr., Jay Carney, and Karen LeBlanc, 2000. *Bayou Courtableau Watershed TMDL for Dissolved Oxygen, Subsegment 060204, Volume I, TMDL Report*, Engineering Section 2, Environmental Technology Division, Office of Environmental Assessment, Louisiana Department of Environmental Quality, 22pp.

LDEQ Ambient Water Quality Database (http://www.deq.state.la.us/surveillance/wqdata/0648col.txt)

LDEQ, 1993. *State of Louisiana Water Quality Management Plan, Volume 6, Part A: Nonpoint Source Pollution Assessment Report*. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge,LA.

APPENDIX A. Fecal Coliform data and loading calculations for each season.

Bayou Joe Marcel near Ville Platte, Louisiana
(http://www.deq.state.la.us/surveillance/wqdata/0648col.txt)

This page last updated on: 12/05/01

DATE	TIME		FECAL COLIFORM MPN/100ML	TOTAL COLIFORM MPN/100ML
12/08/98	1135	L	16000	.
11/23/98	1330		900	.
11/09/98	1200		2400	.
10/27/98	1155		300	.
10/13/98	1100		900	.
09/22/98	1115		900	.
09/08/98	1045		5000	.
08/11/98	1200		3000	.
07/28/98	1152		900	.
07/14/98	1110	L	16000	.
06/23/98	1156		900	

Secondary Contact Use:
Average Fecal Coliform Concentration (11/9/98 – 12/8/98) = 6433 cfu/100ml

Primary Contact Use:
Average Fecal Coliform Concentration (6/23/98 – 10/27/98) = 3487 cfu/100ml

APPENDIX B. Flow information.

Bayou Joe Marcel (Subsegment 050102) - Based on the runoff for the USGS station on Bayou Des Cannes near Eunice, 2.11 CFS per square mile, and a drainage area for Bayou Joe Marcel Subsegment (050102) 14.38 square miles, the average stream flow is estimated to be 30.34 CFS. The May - October average flow is estimated (22.15 CFS) to be about 73% of the annual average flow; the November - April average flow is estimated (38.53 CFS) to be about 127% of the annual average flow.